

**WHAT IS CLAIMED IS:**

- 1           1. A drive circuit which produces a drive signal for a device having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to change dynamically the  
3 drive signal during real time operation of the device.
- 1           2. The apparatus of claim 1, wherein the drive circuit changes dynamically a  
2 shape of a waveform of the drive signal.
- 1           3. The apparatus of claim 1, wherein the drive signal comprises charge packets  
2 which are integrated by the piezoelectric actuator.
- 1           4. The apparatus of claim 1, wherein the drive circuit comprises a pulse width  
2 modulator which changes dynamically, during real time operation of the device, widths  
3 of pulses from which the drive signal is derived.
- 1           5. The apparatus of claim 1, wherein the drive circuit changes dynamically the  
2 drive signal in dependence upon an operational parameter of the device.
- 1           6. The apparatus of claim 1, wherein the drive circuit changes dynamically the  
2 drive signal in dependence upon a sensed operational parameter of the device.
- 1           7. The apparatus of claim 6, wherein the sensed operational parameter of the  
2 device is resonance of the piezoelectric actuator.
- 1           8. The apparatus of claim 6, wherein the sensed operational parameter of the  
2 device is temperature.
- 1           9. The apparatus of claim 1, wherein the drive circuit changes dynamically the  
2 drive signal in dependence upon a sensor signal which is obtained from a sensor.
- 1           10. The apparatus of claim 9, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           11. The apparatus of claim 9, wherein the sensor signal bears an indication of  
2 temperature.

1           12. The apparatus of claim 1, wherein the drive circuit changes dynamically one  
2 of voltage and frequency of the drive signal.

1           13. The apparatus of claim 1, wherein the drive circuit changes dynamically one  
2 of voltage and frequency of the drive signal in accordance with an input signal to the  
3 drive circuit.

1           14. The apparatus of claim 13, wherein the input signal is obtained from a user  
2 input device.

1           15. The apparatus of claim 1, wherein the device is a pump.

1           16. The apparatus of claim 15, wherein the drive circuit changes dynamically  
2 the drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous dosage of fluid is delivered by the pump.

1           17. The apparatus of claim 16, wherein the drive circuit changes dynamically  
2 the drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous intermittent dosage of fluid is delivered by the pump.

1           18. A drive circuit which produces a digital drive signal for a device having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to generate the drive signal  
3 in accordance with an analog input signal to the drive circuit.

1           19. The apparatus of claim 18, wherein the drive circuit is arranged to change  
2 dynamically the drive signal in accordance with the analog input signal to the drive  
3 circuit.

1           20. The apparatus of claim 18, wherein the analog input signal to the drive  
2 circuit is acquired from a sensor.

1           21. The apparatus of claim 20, wherein the analog input signal bears an  
2 indication of resonance of the piezoelectric actuator.

1           22. The apparatus of claim 20, wherein the analog input signal bears an  
2 indication of temperature.

1           23. The apparatus of claim 18, wherein the analog input signal bears an  
2 indication of one of a desired voltage and a desired frequency of the drive signal.

1           24. The apparatus of claim 23, wherein the input signal is obtained from a user  
2 input device.

1           25. A drive circuit which produces a drive signal for a device having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to generate the drive signal  
3 whereby a waveform of the drive signal is shaped in dependence upon an operational  
4 parameter of the device.

1           26. The apparatus of claim 25, wherein the drive circuit dynamically shapes the  
2 waveform of the drive signal in dependence upon the operational parameter of the  
3 device during real time operation of the device.

1           27. The apparatus of claim 25, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           28. The apparatus of claim 25, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses from which the waveform of the drive signal  
3 is derived in dependence upon the operational parameter of the device.

1           29. The apparatus of claim 25, wherein the drive circuit shapes the waveform of  
2 the drive signal in dependence upon a sensed operational parameter of the device.

1           30. The apparatus of claim 29, wherein the sensed operational parameter of the  
2 device is resonance of the piezoelectric actuator.

1           31. The apparatus of claim 29, wherein the sensed operational parameter of the  
2 device is temperature.

1           32. A drive circuit which produces a drive signal for a device having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to generate the drive signal  
3 whereby a waveform of the drive signal is shaped in dependence upon a sensor signal  
4 which is obtained from a sensor.

1           33. The apparatus of claim 32, wherein the drive circuit dynamically shapes the  
2 waveform of the drive signal in dependence upon the operational parameter of the  
3 device during real time operation of the device.

1           34. The apparatus of claim 32, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           35. The apparatus of claim 32, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses from which the waveform of the drive signal  
3 is derived in dependence upon the sensor signal which is obtained from the sensor.

1           36. The apparatus of claim 32, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           37. The apparatus of claim 32, wherein the sensor signal bears an indication of  
2 temperature.

1           38. The apparatus of claim 32, wherein the sensor signal bears an indication of  
2 voltage.

1           39. The apparatus of claim 32, wherein the drive circuit changes voltage of the  
2 drive signal in accordance with the input to the drive circuit.

1           40. A drive circuit which produces a drive signal for a device having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to generate the drive signal  
3 whereby one of voltage and frequency of the drive signal is determined in dependence  
4 upon an input signal to the drive circuit.

1           41. The apparatus of claim 40, wherein the input signal is obtained from a user  
2 input device.

1           42. The apparatus of claim 40, wherein the drive circuit dynamically changes  
2 the one of voltage and frequency of the drive signal during real time operation of the  
3 device.

1           43. The apparatus of claim 40, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           44. A drive circuit which produces a drive signal for a pump having a  
2 piezoelectric actuator, wherein the drive circuit is arranged to generate the drive signal  
3 whereby the drive signal varies over time so that an essentially non-continuous dosage  
4 of fluid is delivered by the pump.

1           45. The apparatus of claim 44, wherein the drive circuit dynamically changes  
2 the drive signal over time during real time operation of the pump whereby a differing  
3 dosage of fluid is delivered by the pump after the change.

1           46. The apparatus of claim 44, wherein the drive signal is a digital signal.

1           47. The apparatus of claim 44, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses from which the waveform of the drive signal  
3 is derived so that the drive signal varies over time.

1           48. A piezoelectric-actuated device comprising:  
2 a piezoelectric actuator which is responsive to a drive signal; and  
3 a drive circuit which produces the drive signal, the drive circuit being arranged  
4 to change dynamically the drive signal during real time operation of the device.

1           49. The apparatus of claim 48, wherein the device is a pump having a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, wherein the piezoelectric actuator is situated  
4 in the pump body and responsive to the drive signal for pumping fluid between the inlet  
5 and outlet; and wherein the drive circuit produces the drive signal, the drive circuit

6 being arranged to change dynamically the drive signal during real time operation of the  
7 pump.

1 50. The apparatus of claim 49, wherein the drive circuit changes dynamically  
2 the drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous dosage of fluid is delivered by the pump.

1 51. The apparatus of claim 50, wherein the drive circuit changes dynamically  
2 the drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous intermittent dosage of fluid is delivered by the pump.

1 52. The apparatus of claim 48, wherein the drive circuit changes dynamically a  
2 shape of a waveform of the drive signal.

1 53. The apparatus of claim 48, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1 54. The apparatus of claim 48, wherein the drive circuit comprises a pulse width  
2 modulator which changes dynamically, during real time operation of the device, widths  
3 of pulses from which the drive signal is derived.

1 55. The apparatus of claim 48, wherein the drive circuit changes dynamically  
2 the drive signal in dependence upon an operational parameter of the device.

1 56. The apparatus of claim 48, wherein the drive circuit changes dynamically  
2 the drive signal in dependence upon a sensed operational parameter of the device.

1 57. The apparatus of claim 56, wherein the sensed operational parameter of the  
2 device is resonance of the piezoelectric actuator.

1 58. The apparatus of claim 56, wherein the sensed operational parameter of the  
2 device is temperature.

1 59. The apparatus of claim 48, wherein the drive circuit changes dynamically  
2 the drive signal in dependence upon a sensor signal which is obtained from a sensor.

1           60. The apparatus of claim 59, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           61. The apparatus of claim 59, wherein the sensor signal bears an indication of  
2 temperature.

1           62. The apparatus of claim 48, wherein the drive circuit changes dynamically  
2 one of voltage and frequency of the drive signal.

1           63. The apparatus of claim 48, wherein the drive circuit changes dynamically  
2 one of voltage and frequency of the drive signal in accordance with an input signal to  
3 the drive circuit.

1           64. The apparatus of claim 63, wherein the input signal is obtained from a user  
2 input device.

1           65. A piezoelectric-actuated device comprising:  
2 a piezoelectric which is responsive to a digital drive signal; and  
3 a drive circuit which produces the drive signal, the drive circuit being arranged  
4 to generate the drive signal in accordance with an analog input signal to the drive  
5 circuit.

1           66. The apparatus of claim 65, wherein the device is a pump comprising a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, and wherein the piezoelectric actuator is  
4 situated in the pump body and responsive to the digital drive signal for pumping fluid  
5 between the inlet and outlet.

1           67. The apparatus of claim 65, wherein the drive circuit is arranged to change  
2 dynamically the drive signal in accordance with the analog input signal to the drive  
3 circuit.

1           68. 59The apparatus of claim 65, wherein the analog input signal to the drive  
2 circuit is acquired from a sensor.

1           69. The apparatus of claim 59, wherein the analog input signal bears an  
2 indication of resonance of the piezoelectric actuator.

1           70. The apparatus of claim 59, wherein the analog input signal bears an  
2 indication of temperature.

1           71. The apparatus of claim 65, wherein the analog input signal bears an  
2 indication of one of a desired voltage and a desired frequency of the drive signal.

1           72. The apparatus of claim 71, wherein the input signal is obtained from a user  
2 input device.

1           73. A piezoelectric-actuated device comprising:  
2 a piezoelectric actuator which is responsive to a drive signal; and  
3 a drive circuit which produces the drive signal, the drive circuit being arranged  
4 to generate the drive signal in dependence upon an operational parameter of the device.

1           74. The apparatus of claim 73, wherein the device is a pump having a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, wherein the piezoelectric actuator is situated  
4 in the pump body and responsive to the drive signal for pumping fluid between the inlet  
5 and outlet.  
6

1           75. The apparatus of claim 73, wherein the drive circuit dynamically shapes the  
2 waveform of the drive signal in dependence upon the operational parameter of the  
3 pump during real time operation of the device.

1           76. The apparatus of claim 73, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           77. The apparatus of claim 73, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses of the waveform of the drive signal in  
3 dependence upon the operational parameter of the device.



1           78. The apparatus of claim 73, wherein the drive circuit shapes the waveform of  
2 the drive signal in dependence upon a sensed operational parameter of the device.

1           79. The apparatus of claim 78, wherein the sensed operational parameter of the  
2 pump is resonance of the piezoelectric actuator.

1           80. The apparatus of claim 78, wherein the sensed operational parameter of the  
2 device is temperature.

1           81. A piezoelectric-actuated device comprising:  
2 a piezoelectric actuator which is responsive to a drive signal;  
3 a sensor which generates a sensor signal; and  
4 a drive circuit which produces the drive signal, the drive circuit being arranged  
5 to generate the drive signal in dependence upon the sensor signal.

1           82. The apparatus of claim 81, wherein the device is a pump comprising a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, wherein the piezoelectric actuator is situated  
4 in the pump body and responsive to the drive signal for pumping fluid between the inlet  
5 and outlet.

1           83. The apparatus of claim 81, wherein the drive circuit dynamically shapes the  
2 waveform of the drive signal in dependence upon the operational parameter of the  
3 pump during real time operation of the device.

1           84. The apparatus of claim 81, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           85. The apparatus of claim 81, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses of the waveform of the drive signal in  
3 dependence upon the sensor signal.

1           86. The apparatus of claim 81, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           87. The apparatus of claim 81, wherein the sensor signal bears an indication of  
2 temperature.

1           88. The apparatus of claim 81, wherein the sensor signal bears an indication of  
2 voltage.

1           89. The apparatus of claim 81, wherein the drive circuit changes voltage of the  
2 drive signal in accordance with the input to the drive circuit.

1           90. A piezoelectric-actuated device comprising:  
2 a piezoelectric actuator which is responsive to a drive signal; and  
3 a drive circuit which produces the drive signal, the drive circuit being arranged  
4 to generate the drive signal whereby one of voltage and frequency of the drive signal is  
5 determined in dependence upon an input signal to the drive circuit.

1           91. The apparatus of claim 63, wherein the device is a pump comprising a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, and wherein the piezoelectric actuator is  
4 situated in the pump body and responsive to the drive signal for pumping fluid between  
5 the inlet and outlet.

1           92. The apparatus of claim 63, wherein the input signal is obtained from a user  
2 input device.

1           93. The apparatus of claim 63, wherein the drive circuit dynamically changes  
2 the one of voltage and frequency of the drive signal during real time operation of the  
3 device.

1           94. The apparatus of claim 63, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           95. A piezoelectric-actuated device comprising:  
2 a piezoelectric actuator which is responsive to a drive signal; and

3 a drive circuit which produces the drive signal, the drive circuit being arranged  
4 to generate the drive signal whereby the drive signal varies over time so that the device  
5 is operated essentially non-continuously.

1 96. The apparatus of claim 95, wherein the device is a pump comprising a pump  
2 body for at least partially defining a pumping chamber and an inlet and an outlet which  
3 communicate with the pumping chamber, and wherein the piezoelectric actuator is  
4 situated in the pump body and responsive to the drive signal for pumping fluid between  
5 the inlet and outlet; and wherein the drive signal varies over time so that an essentially  
6 non-continuous dosage of fluid is delivered by the pump.

1 97. The apparatus of claim 96, wherein the drive circuit dynamically changes  
2 the drive signal over time during real time operation of the pump whereby a differing  
3 dosage of fluid is delivered by the pump after the change.

1 98. The apparatus of claim 95, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1 99. The apparatus of claim 95, wherein the drive circuit comprises a pulse width  
2 modulator which shapes widths of pulses of the waveform of the drive signal so that the  
3 drive signal varies over time.

1 100. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal, the method comprising:  
3 dynamically changing the drive signal during real time operation of the device;  
4 actuating the piezoelectric actuator in response to the drive signal.

1 101. The method of claim 100, further comprising dynamically changing the  
2 drive signal whereby the drive signal varies over time so that the device operates on an  
3 essentially non-continuous basis.

1 102. The method of claim 100, wherein the device is a pump and the  
2 piezoelectric actuator is situated in a pump body and responsive to the drive signal for  
3 pumping fluid between an inlet and an outlet of the pump body, and wherein the  
4 method further comprises:

5           dynamically changing the drive signal during real time operation of the pump;  
6           actuating the piezoelectric actuator in response to the drive signal to pump the  
7 fluid between the inlet and the out of the pump body.

1           103. The method of claim 102, further comprising dynamically changing the  
2 drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous dosage of fluid is delivered by the pump.

1           104. The method of claim 103, further comprising dynamically changing the  
2 drive signal whereby the drive signal varies over time so that an essentially non-  
3 continuous intermittent dosage of fluid is delivered by the pump.

1           105. The method of claim 100, wherein the method comprises dynamically  
2 changing a shape of a waveform of the drive signal.

1           106. The method of claim 100, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           107. The method of claim 100, further comprising using a pulse width  
2 modulator for dynamically changing, during real time operation of the pump, widths of  
3 pulses from which the drive signal is derived.

1           108. The method of claim 100, further comprising dynamically changing the  
2 drive signal in dependence upon an operational parameter of the device.

1           109. The method of claim 100, further comprising dynamically changing the  
2 drive signal in dependence upon a sensed operational parameter of the device.

1           110. The method of claim 109, wherein the sensed operational parameter of the  
2 pump is resonance of the piezoelectric actuator.

1           111. The method of claim 109, wherein the sensed operational parameter is  
2 temperature.

1           112. The method of claim 100, further comprising dynamically changing the  
2 drive signal in dependence upon a sensor signal which is obtained from a sensor.

1           113. The method of claim 112, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           114. The method of claim 112, wherein the sensor signal bears an indication of  
2 temperature.

1           115. The method of claim 100, further comprising dynamically changing one of  
2 voltage and frequency of the drive signal.

1           116. The method of claim 100, further comprising dynamically changing one of  
2 voltage and frequency of the drive signal in accordance with an input signal to the drive  
3 circuit.

1           117. The method of claim 116, further comprising obtaining the input signal  
2 from a user input device.

1           118. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal , the method comprising:  
3           generating the drive signal in accordance with an analog input signal to the drive  
4 circuit;  
5           actuating the piezoelectric actuator in response to the drive signal.

1           119. The method of claim 118, wherein the device is a piezoelectric pump  
2 having the piezoelectric actuator situated in a pump body and responsive to the drive  
3 signal for pumping fluid between an inlet and an outlet of the pump body, and wherein  
4 the method further comprises actuating the piezoelectric actuator in response to the  
5 drive signal to pump the fluid between the inlet and the outlet of the pump body.

1           120. The method of claim 118, further comprising dynamically changing the  
2 drive signal in accordance with the analog input signal to the drive circuit.

1           121. The method of claim 118, further comprising acquiring the analog input  
2 signal to the drive circuit from a sensor.

1           122. The method of claim 121, wherein the analog input signal bears an  
2 indication of resonance of the piezoelectric actuator.

1           123. The method of claim 121, wherein the analog input signal bears an  
2 indication of temperature.

1           124. The method of claim 118, wherein the analog input signal bears an  
2 indication of one of a desired voltage and a desired frequency of the drive signal.

1           125. The method of claim 124, further comprising obtaining the input signal  
2 from a user input device.

1           126. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal , the method comprising:  
3           generating the drive signal in dependence upon an operational parameter of the  
4 device;  
5           actuating the piezoelectric actuator in response to the drive signal.

1           127. The method of claim 126, wherein the device is a piezoelectric pump  
2 having the piezoelectric actuator situated in a pump body and responsive to the drive  
3 signal for pumping fluid between an inlet and an outlet of the pump body, and wherein  
4 the method further comprises actuating the piezoelectric actuator in response to the  
5 drive signal to pump the fluid between the inlet and the outlet of the pump body.

1           128. The method of claim 126, further comprising dynamically shaping the  
2 waveform of the drive signal in dependence upon the operational parameter of the  
3 device during real time operation of the device.

1           129. The method of claim 126, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           130. The method of claim 126, further comprising using a pulse width  
2 modulator to shape widths of pulses of the waveform of the drive signal in dependence  
3 upon the operational parameter of the device.

1           131. The method of claim 126, further comprising the drive circuit shaping the  
2 waveform of the drive signal in dependence upon a sensed operational parameter of the  
3 device.

1           132. The method of claim 131, wherein the sensed operational parameter of the  
2 device is resonance of the piezoelectric actuator.

1           133. The method of claim 131, wherein the sensed operational parameter is  
2 temperature.

1           134. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal , the method comprising:  
3           generating the drive signal in dependence upon a sensor signal;  
4           actuating the piezoelectric actuator in response to the drive signal.

1           135. The method of claim 134, wherein the device is a piezoelectric pump  
2 having the piezoelectric actuator situated in a pump body and responsive to the drive  
3 signal for pumping fluid between an inlet and an outlet of the pump body, and wherein  
4 the method further comprises actuating the piezoelectric actuator in response to the  
5 drive signal to pump the fluid between the inlet and the outlet of the pump body.

1           136. The method of claim 134, further comprising dynamically shaping the  
2 waveform of the drive signal in dependence upon a sensor signal during real time  
3 operation of the device.

1           137. The method of claim 134, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           138. The method of claim 134, further comprising using a pulse width  
2 modulator for shaping widths of pulses from which the waveform of the drive signal is  
3 derived in dependence upon the sensor signal.

1           139. The method of claim 134, wherein the sensor signal bears an indication of  
2 resonance of the piezoelectric actuator.

1           140. The method of claim 134, wherein the sensor signal bears an indication of  
2 temperature.

1           141. The method of claim 134, wherein the sensor signal bears an indication of  
2 voltage.

1           142. The method of claim 134, further comprising the drive circuit changing  
2 voltage of the drive signal in accordance with the input to the drive circuit.

1           143. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal, the method comprising:  
3           generating the drive signal whereby one of voltage and frequency of the drive  
4 signal is determined in dependence upon an input signal to the drive circuit;  
5           actuating the piezoelectric actuator in response to the drive signal

1           144. The method of claim 143, wherein the device is a piezoelectric pump  
2 having the piezoelectric actuator situated in a pump body and responsive to the drive  
3 signal for pumping fluid between an inlet and an outlet of the pump body, and wherein  
4 the method further comprises actuating the piezoelectric actuator in response to the  
5 drive signal to pump the fluid between the inlet and the outlet of the pump body.

1           145. The method of claim 143, further comprising obtaining the input signal  
2 from a user input device.

1           146. The method of claim 143, further comprising dynamically changing the  
2 one of voltage and frequency of the drive signal during real time operation of the  
3 device.

1           147. The method of claim 143, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.



1           148. A method of operating a device having a piezoelectric actuator which is  
2 responsive to a drive signal, the method comprising varying the drive signal varies over  
3 time so that the device operates essentially non-continuously.

1           149. The method of claim 148, wherein the device is a piezoelectric pump  
2 having the piezoelectric actuator situated in a pump body and responsive to the drive  
3 signal for pumping fluid between an inlet and an outlet of the pump body, and wherein  
4 the method further comprises varying the drive signal varies over time so that an  
5 essentially non-continuous dosage of fluid is delivered by the pump.

1           150. The method of claim 149, further comprising dynamically changing the  
2 drive signal over time during real time operation of the pump whereby a differing  
3 dosage of fluid is delivered by the pump after the change.

1           151. The method of claim 148, wherein the drive signal comprises charge  
2 packets which are integrated by the piezoelectric actuator.

1           152. The method of claim 148, further comprising using a pulse width  
2 modulator for shaping widths of pulses of the waveform of the drive signal so that the  
3 drive signal varies over time.